Notes ichtyologiques / *Ichthyological notes*

First record and new meristic data of *Gobius xanthocephalus* (Gobiidae) from Galician waters (NW Spain)

by

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RÉSUMÉ. - Premier signalement et nouvelles données méristiques de *Gobius xanthocephalus* (Gobiidae) en Galice (NO Espagne).

Le gobie à tête jaune, *Gobius xanthocephalus*, est signalé pour la première fois en Galice. Ce rapport établit une nouvelle limite nord de la répartition de cette espèce dans l'océan Atlantique. De nouveaux caractères méristiques et descriptifs sont présentés : rayons branchiostèges, nombre de branchiospines et de vertèbres, et description des dents et des otolithes. On propose de substituer *Gobius auratus* par *G. xanthocephalus* dans la liste de l'ichtyofaune galicienne.

Key words. - Gobiidae - *Gobius xanthocephalus* - New record - New meristic data - Galician ichthyofaune.

The golden goby *Gobius auratus* Risso, 1810 and the yellow-headed goby *Gobius xanthocephalus* Heymer & Zander, 1992 have been classically puzzled under the denomination of the former. In 1992, Heymer and Zander separated the two species with the description of a new species, *G. xanthocephalus*, from the Mediterranean Sea and the designation of a neotype of *G. auratus*. Since then, it became a necessity to reconsider, as far as possible, the ancient records of *G. auratus*, and to reassign the distribution area of the new species.

After that work, Wirtz and Herrera (1995), Almeida and Arruda (1998), Vasil'eva and Bogorodskii (2004) and Guidetti *et al.* (2005), widened the distribution range of *G. xanthocephalus* to new areas in the Mediterranean Sea and the Atlantic Ocean. Most of these authors reassigned the ancient records of *G. auratus* to *G. xanthocephalus*, confirming the misidentification of the species in the past, and thus indicating the absence of the former.

Some biological and ecological aspects were also studied. Almeida and Arruda (1998) provided some data about the morphology and ecology. The diet was studied by Zander (1982, 1986), Zander and Berg (1984) and Zander and Hagemann (1989), but as *G. auratus*. Herler *et al.* (2005) made a revision of this species, including the genetic relationships with other members of the *G. auratus* species complex. Recently, Monteiro *et al.* (2008) described the larval stages of the species.

In Galicia (NW Spain), *G. auratus* was recorded by De Buen (1918, 1935) and Iglesias (1981). Heymer and Zander (1992) pointed out that this last report should probably be *G. xanthocephalus*. However, its presence has never been confirmed.

The present work provides the main morphological and ecological features and discusses about the current status of the species in Galician waters.

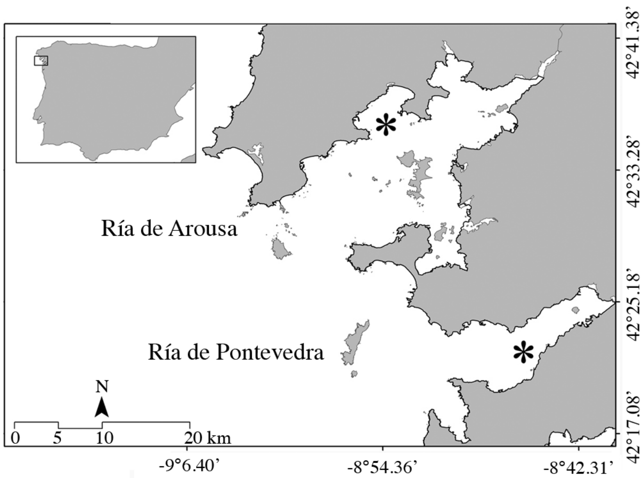

Figure 1. - Map of Galicia showing the sampling locations.

MATERIAL AND METHODS

The specimens described were caught during 2008 in two localities in the south of Galicia: Ría de Pontevedra (42°23.76'N; 8°43.55'W) and Ría de Arousa (42º37.59' N; 8º54.64' W) (Fig. 1).

The description of the colour of living individuals was made on the basis of underwater observations, videos and photos taken during a large number of dives between February and May 2008, in depths ranging from 1 to 22 m. Seven of the eighteen specimens examined were caught with the aid of a small aquarium net in SCUBA diving, and the other eleven were captured during a trap fishery for velvet swimming crab *Necora puber* (Linnaeus, 1767) at 4 m depth.

The specimens were preserved frozen for further analysis. Measurements to the nearest 0.1 mm and meristic are those of Miller (1988). Identification to species level and pores and papillae terminology follows Heymer and Zander (1992, 1994). For examination of the dentition, otoliths and vertebrae counts, four specimens between 64 and 92 mm TL were decomposed in water at 35ºC during a week. Otoliths description was made according to Tuset *et al.* (2008).

After examination, the specimens were fixed in 4% formaldehyde for one week, transferred to ethanol 70% and stored in the Museum Luis Iglesias (University of Santiago de Compostela) with the collection numbers 6263 to 6280.

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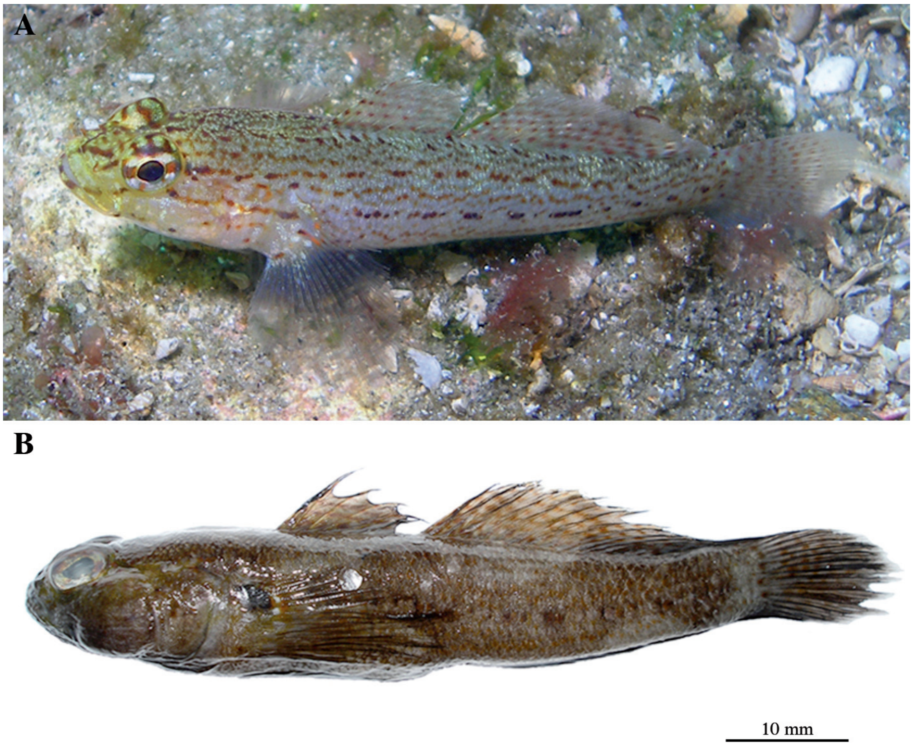

Figure 2. - Live (A) and preserved (B) coloration of Gobius xanthocephalus from Galician waters. MUSEO HN USC 6263 to 6280.

RESULTS

Description

The number of meristic characters is followed by the number of specimens in parentheses. First dorsal fin rays: VI (18); second dorsal: I (18) + 14 (3), 15 (12), 16 (3); anal: I (18)+ 13(1), 14(15), 15(2); pectoral: 19/19 (16) - 20/20 (2); ventral: I (18)+5 (18); caudal: 14 (6), 15(12); lateral line scales: 45-50; branchiostegal rays: 5 (18); gill rakers: 2 + 1 + 7-10 = 10-13; vertebrae (including urostyle): 27-29.

The size range of the 18 specimens examined was 47 to 94 mm TL (37 to 77 mm SL). The percentage range of standard length is followed by the mean ± SD in parentheses. Head length: 25.0-38.7 (28.8 ± 3.0); preorbital length: 4.0-7.7 (5.8 ± 1.1); postorbital length: 13.1-17.5 (15.5 ± 1.2); eye diameter: 5.4-8.9 (6.9 ± 1.1); interorbital length: 1.3-2.7 (1.9 ± 0.4); first predorsal length: 31.2-36.8 (33.8 ± 1.7); second predorsal length: 49.2-55.4 (53.3 ± 1.6); first dorsal base length, 13.2-19.7 (16.9 ± 1.9); second dorsal base length: 27.0-38.2 (32.4 ± 2.7); preanal length: 48.1-62.2 (56.7 ± 4.0); anal base length: 22.6-30.7 (25.4 ± 1.6); pectoral length: 22.1-32.3 (25.2 ± 2.5); ventral length: 14.3-24.3 (20.0 ± 2.4); body height: 16.3-23.5 (19.6 ± 2.0); body width: 13.5-20.3 (16.9 ± 1.7).

Body elongated, subcylindrical, trunk laterally compressed; eye diameter about 25 % of head length; fifth ray of the first dorsal fin projecting; first and second dorsal fins separated by a gap; pectoral fin reaching back to below second dorsal fin origin; 3 to 4 uppermost pectoral rays clearly free from membrane, with deeply bifid ends; caudal fin rounded, shorter than head; ventral fin not reaching the anus; disc vaguely emarginated; ventral frenum (anterior membrane) well developed; trunk scales mostly ctenoid; small cycloid scales in the nape and predorsal area; larger cycloid scales on the breast; cheeks bare; anterior narine at the top of a small tube, posterior narine just a pore. Gill rakers moderately long, soft (weak) and conical, sometimes rudimentary at the edge of the arch.

Well developed head canal system. Anterior oculoscapular canal with pores σ, λ, $\varkappa$, ω, α, β and ϱ; posterior oculoscapular canal with pores ϱ' and ϱ'' and preopercular canal with pores γ, δ and ε. Suborbital papillae in six vertical rows: *1* to *4* extending to near horizontal row *d*, rows *5* and *6* interrupted by horizontal row *b*; *6i* starting clearly under row *b*, and ending under row *d*; row *d* in three segments, *I* and *II* close but not superposed, segment *III* clearly separated. Opercular papillae with row *ot* almost right, row *oi* and *os* well separated from *ot*; row *oi* horizontal and with less papillae than row *os*, which is oblique. Three occipital rows of papillae: *o*, *g* and *m*; right and left rows *o* not in contact. Row α, near pore α, with two papillae. Row x^1 not reaching pore β. See drawings in Vasil'eva and Bogorodskii (2004) and Herler *et al*. (2005).

Otoliths rhomboidal in shape with one anterior ventral and one posterior dorsal projection; dorsal margin convex, sinuate to slightly dentate; sulcus acusticus homosulcoid, mesial, supramedian, ascending; ostium round to oval, as long as the cauda, ending far from the anterior margin; cauda round to oval, ending far from the posterior margin; anterior region oblique, with a round to sharply pointed ventral; posterior region oblique to irregular, with a middle shallow notch separating a short, round to angular ventral lobe, and a long sharply round dorsal lobe.

Numerous canine and erect teeth in upper and lower jaw on the premaxilla and the dentary. Premaxilla with an outer row of large and spaced out teeth along its entire rim and 2-3 inner rows of smaller teeth. Dentary with an anterior outer row of 4-6 large teeth followed by 2-3 inner rows of small teeth laterally tapering to a uniserial row of medium size teeth. Pharyngeal teeth present and vomer and palatine teeth absent.

Coloration

Observed life coloration of *Gobius xanthocephalus* (Fig. 2A) characterized by a pale greyish trunk more intense in the back

Table I. - Meristic data available for *Gobius xanthocephalus* including present results. D1: first dorsal fin; D2: second dorsal fin; A: anal fin; P: pectoral fins; V: ventral fin; C: caudal fin; SLL: scales in lateral line.

Source	n	Area	D1	D2	A	P	V	C	SLL
Heymer and Zander, 1992	63	Mediterranean	V1	I/13-16	I/13-15	18/18-20/20	I/5	13-15	42-48
Almeida and Arruda, 1998	26	Portugal	VI	I/14-16	I/13-15	19-21	I/5	17	44-50
Herler *et al*., 2005	13	Mediterranean and Atlantic	VI	I/15(14-15)	I/14(13-15)	19-20	I/5	14-15	42-48
Present work	18	Galicia	VI	I/14-16	I/14-15	19/19-20/20	I/5	14-15	45-50

becoming almost white in the ventral zone. Golden-yellow head, from the posterior edge of the eyes to the upper lip, reaching the inferior lip with less intensity. In a lateral view, a slight yellow shade reaching the opercula. Trunk with a dorsal greenish iridescence, from the end of the head to the start of the caudal fin. Body covered of red and brown horizontal dotted lines, from the pectoral fin to the caudal fin, the middle line one more evident and darker than the others. Two red stripes on the eyes parallel to the lines on the body, an unbroken one above the pupil and the other in the horizontal eye diameter, interrupted at the pupil level. Two radial lines from the pupil to the lower edge of the orbit, and three more lines in the upper surface of the eye ball. V-shaped stripe on the snout. Short line from the anterior edge of the eye ball to the middle of the upper jaw, and another one from the lower edge of the orbit to the upper jaw. One evident stripe running from the lower orbit edge to the pectoral base. Dorsal fins with a horizontal pattern of red spot rows, which were vertical in the caudal fin. The distal part of the dorsal fins with a bluish line. Caudal, anal and pectoral fins displaying radial bluish lines. One dark blue oval spot in the upper base of the pectoral fins, bordered by alternating white and orange points.

Preserved (frozen) *G. xanthocephalus* (Fig. 2B) dominated by a greyish trunk, almost brown in the dorsa and light grey in the ventral zone. Body flanks covered of red and brown spots in horizontal lines. Head with small red spots all around, even ventrally. Body displaying several (9-10) dark grey vertical bands, sometimes inconspicuous or absent. One dark black spot in the base of the pectoral fins, and an orange smaller one close to it. Red lines in the fins still evident, but bluish lines in the edges disappeared. Yellow coloration lighter and reduced to the opercula area, when present. Greenish iridescence completely absent. Iris coloration pattern maintained as in living individuals.

Habitat and behaviour

Gobius xanthocephalus resulted to be the most abundant member of the Fam. Gobiidae, together with *Gobius cruentatus* Gmelin, 1789 in all the dives in rocky bed between 1 and 22 meters in the Ría de Pontevedra (Fig. 1). It was normally found in small sandy patches associated with rocky habitats, such as boulders. In the absence of any external motivation most of the individuals were found very static resting in the bottom laying on the ventral fins, a typical feature in all the gobies. However they showed an extremely timid behaviour when the diver was nearby, making it difficult to get close to them to take photos or collect the individuals. They were always near to fissures, crevices or small caves to refuge in when they felt unsafe. Usually many adults were found resting together always in the vicinity of a shelter, showing no antagonistic behaviour. Some individuals were found in Maërl substrate, at 20 metres depth. In general terms it was observed a gradient of abundance with depth, being more abundant in shallower waters.

Museum specimens

We examined two specimens identified as *G. auratus* from Galician waters deposited in the Museum Luis Iglesias (collection number 6092) by M. Solórzano between 1978 and 1983. Even though some specific characters were lost with the conservation process we could confirm the misidentification and reassign them to *G. xanthocephalus*.

DISCUSSION

The existence of uppermost rays of the pectoral fins free, the presence of six transversal rows of suborbital papillae and the absence of the horizontal row *a*, the midline scales counts in the range 30 to 65 and the pelvic disc emarginated with reduced anterior membrane confirm the inclusion of the examined individuals in genus *Gobius*, which is represented in Galician waters by other 5 species (already excluding *Gobius auratus*).

Specimens of *Gobius xanthocephalus* differ from *G. auratus* firstly in live coloration, which has an uniformly canary yellow / yellow colour that covers the entire body in both colour morphs 1 and 2 (sensu Herler *et al*., 2005) in *G. auratus;* this species has a less developed frenum than our specimens, it has a membrane connecting the first and second dorsal fins and spatula shaped caudal fin, according to the description of Heymer and Zander (1992, 1994); iris pattern of coloration observed in our fishes (even preserved) is particularly characteristic for *G. xanthocephalus* (Heymer and Zander, 1992, 1994) and thus absent in *G. auratus*. The differences are also evident in the suborbital papillae: fifth transversal row is not divided by lengthwise row *b* and segments of genipores *I* and *II* in serie *d* are superposed in *G. auratus* (Heymer and Zander, 1992).

The meristics counts are among the range of the reported data in the literature for the species (Tab. I). Body measurements and proportions are similar to the values reported by Herler *et al*. (2005) for eight individuals from Portugal, Italy and France. We have only found minor differences: first and second predorsal lengths and preanal length are slightly shorter in our specimens; first dorsal base length is larger and second dorsal and anal base lengths proved to be shorter.

Dentition and otoliths are similar to other described small gobies. Particularly, dentition is very similar to that of *Gobius fallax* Sarato, 1889 and *G. auratus* (Herler *et al*., 2006) and otoliths resemble to those described for *Gobius bucchichi* Steindachner, 1870 (Tuset *et al*., 2008).

General pattern of living coloration agrees with the description of the Mediterranean (Heymer and Zander, 1992, 1994), Portuguese (Almeida and Arruda, 1998) and Black Sea (Vasil'eva and Bogorodskii, 2004) individuals. Greenish iridescence probably corresponds with the "greenish body" mentioned by Wirtz and Herrera (1995) for the Canary Islands individuals. The bluish coloration observed in the dorsal fins by Almeida and Arruda (1998) is confirmed by our observations, and extended to the caudal, anal and pectoral fins. Our specimens presented a clearly blue pectoral spot, which contrasts with the colour given for the Portuguese (Almeida and Arruda, 1998) and the Mediterranean (Heymer and Zander, 1992, 1994) ones, black and brown to black respectively, though this difference may be due to different visual colour appreciation. Preserved coloration matches well with the description of Almeida and Arruda (1998), Herler *et al*. (2005) and Vasil'eva and Bogorodskii (2004) and it differs only with Heymer and Zander (1992, 1994) in the colour of the distal spot in the base of the pectoral fins, white in the original description, whilst yellow in the present study. It is worth noting that our preserved coloration description was based on frozen individuals whilst those of the other authors were mainly based on formalin-conserved fishes.

Depth distribution is among the reported range in the literature, between 1 and 36 m. The reported negative gradient of density with depth was also observed by Wirtz and Herrera (1995).

The habitat for the species in Galician waters is the general habitat described in literature. It was also found in rock crevices or caves associated with *Thorogobius ephippiatus* (Lowe, 1839) in the Portuguese coast (Almeida and Arruda, 1998) and in seagrass grounds in the Mediterranean Sea (Heymer and Zander, 1992).

The present work widens the distribution range of the species in the Atlantic Coast and sets a new northern limit of distribution. The authors consider that the ancient cites of *G. auratus* in Galicia (De Buen, 1918, 1935; Iglesias, 1981) should correspond in fact to *G. xanthocephalus*, as pointed by Heymer and Zander (1992), and propose the exclusion of the former from the list of Galician fishes. From the redescription of *G. auratus*, no specimen of this species was ever reliably identified in this region.

The confirmed distribution of the species includes the Western Mediterranean: France (Banyuls-sur-Mer, île Grosse) (Heymer and Zander, 1992), Italy (Gulf of Genova, Savona) (Balma, G.A.C. *in* Herler *et al*., 2005) and Balearic Islands (Portinatx) (Fischer *et al*., 2007); Adriatic Sea (Miramare) (Guidetti *et al*., 2005); Black Sea; eastern Atlantic: Canary Islands (Tenerife) (Wirtz and Herrera, 1995), south-western Portugal (Arrábida) (Almeida and Arruda, 1998) and NW Spain (south coast of Galicia) (present work); unconfirmed records in the Cantabrian Sea (M. Cortés, pers. comm.).

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